NAVIS
Navy Input Station

Real-Time Image Processing, Display, and Analysis

The Navy Input Station (NAVIS) is the state-of-the-art in real-time reconnaissance imagery receiving and display. This reconnaissance ground station, developed by the Space Dynamics Laboratory at Utah State University (SDL/USU) under the direction of the Naval Research Laboratory (NRL), is currently configured for use with the Tactical Airborne Reconnaissance Pod System – Completely Digital (TARPS-CD). This is the first completely digital system to provide real-time transmission of step framing imagery to a receiving ground station with real-time image display capabilities.

Proven Capabilities

The NAVIS receives compressed images from a pod-mounted CA-261® digital step framing electro-optical (E-O) camera via a common data link (CDL) transmission. The NAVIS utilizes an integrated link controller, real-time decompression cards, and real-time Image Display Software (IDS) to process the data and display a real-time, continuous stream of tiled image thumbnails. The system allows for simultaneous digital recording and enables operators to view full-resolution images on demand while the real-time stream is active. The IDS also provides tools for image manipulation, including zoom, pan, crop, enhance, save, and print. The NAVIS capabilities have been successfully demonstrated as part of the June 2, 1998, TARPS-CD presentation at the Pentagon and during several missions aboard the USS John F. Kennedy and USS Harry S. Truman.
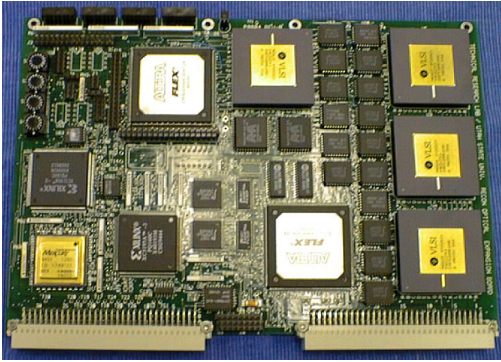
Robust Implementation

The NAVIS provides the capabilities for processing, displaying, and manipulating real-time tactical reconnaissance imagery in a low-cost, rapid prototype solution. The rugged, two-rack system utilizes COTS hardware and can be reconfigured for portability. The standard NAVIS system includes the following components:

- Power distribution panels and UPS units
- Processing unit with keyboard/mouse
- Link controller for the CDL
- Two flat-panel displays
- Digital recorder
- Dual-mode printer
- RAID disk array
- Zip®, CD-R and 8mm tape drives.
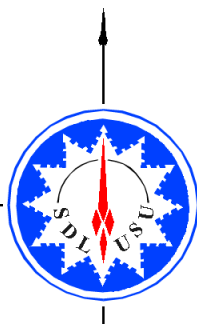
This real-time implementation incorporates a data decompression board developed by SDL/USU that utilizes standard data busses (VME-64 and RACEway) and supports full real-time, 2.5 fps (frames per second) expansion to memory for display, processing, and exploitation.

A non-real-time implementation is also available for use on Windows NT® based personal computers (PCs). This highly portable system uses a PCI interface decompression card developed by SDL/USU and allows for rapid screening of data tapes from the reconnaissance pod.
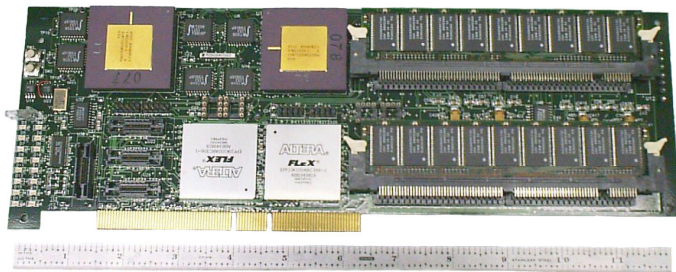

All NAVIS hardware and software components have been implemented in a modular, expandable design to facilitate future upgrades for advanced sensors or higher throughput.

Main CPU   Memory & Tape Interface   CDL & RAID Interface   Decompression Set
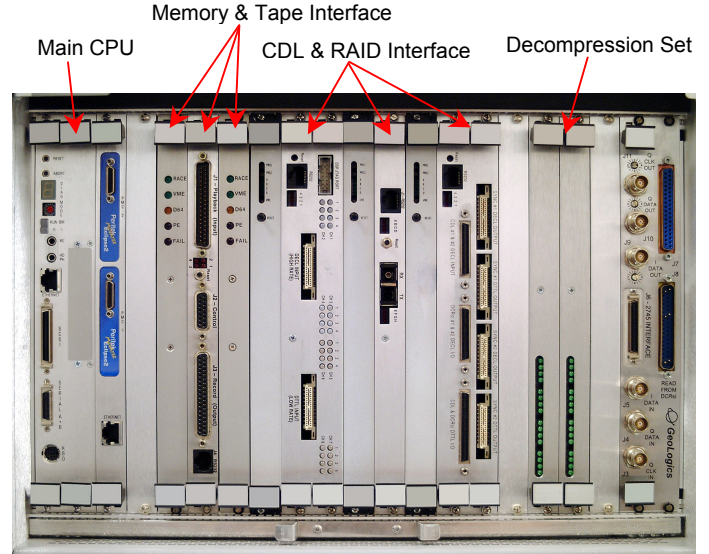
Powerful Display Software

Both the real-time rack-mounted NAVIS system and the non-real-time PC-based version include the Image Display Software (IDS) developed by SDL/USU. The IDS processes the imagery collected from the sensor via direct connection to the camera, from the CDL connection, or from tape. The IDS is capable of displaying imagery in real-time, where "real-time" is defined as "processing data up to the maximum camera framing rate."

The IDS displays continuous data streams in a tiled "waterfall" of decimated image thumbnails. Thumbnails are tiled according to the camera overlap and sequence settings, and advance according to the aircraft and camera positioning. Individual thumbnails can be expanded and displayed separately as full-resolution ($5k \times 5k$) images while the waterfall display is active. To further aid in image analysis, the IDS provides a variety of custom visualization and manipulation capabilities.
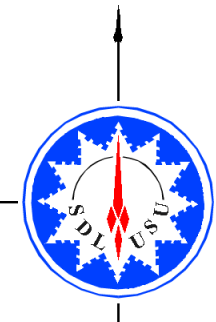
IDS features include:

- User-friendly graphical user interface with online help
- Automatic scaling of the tiled display window
- On-demand display of full resolution images and available annotation data while the waterfall is active
- Image pan, zoom, rotation, and contrast/color enhancement
- Object mensuration on full resolution displays
- Target identification and pointer tracking
- Compass and aircraft direction indicators
- Image clone and multiple window display
- Recorder playback control interface with search features
- Real-time continuous recording of the input stream
- Save to multiple formats, including uncompressed (raw), Sun Raster, compressed (HQVQ), JPEG, TIFF, NITF 2.0 uncompressed, NITF 2.0 JPEG, and NITF 2.1 JPEG
- Simultaneous save to another workstation on the network
- Print to hardcopy with customized image product formats
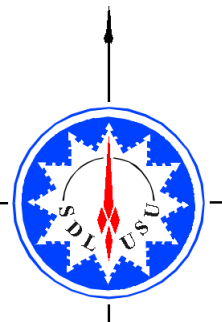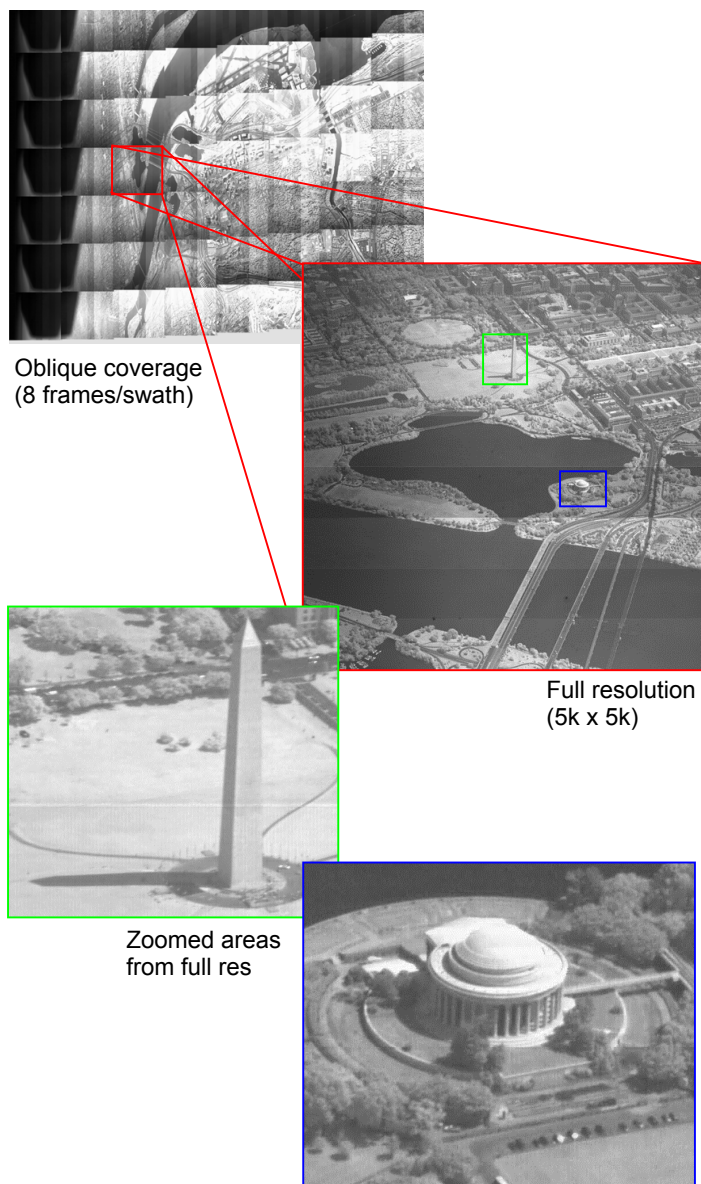- GPS data output with flight mapping application.
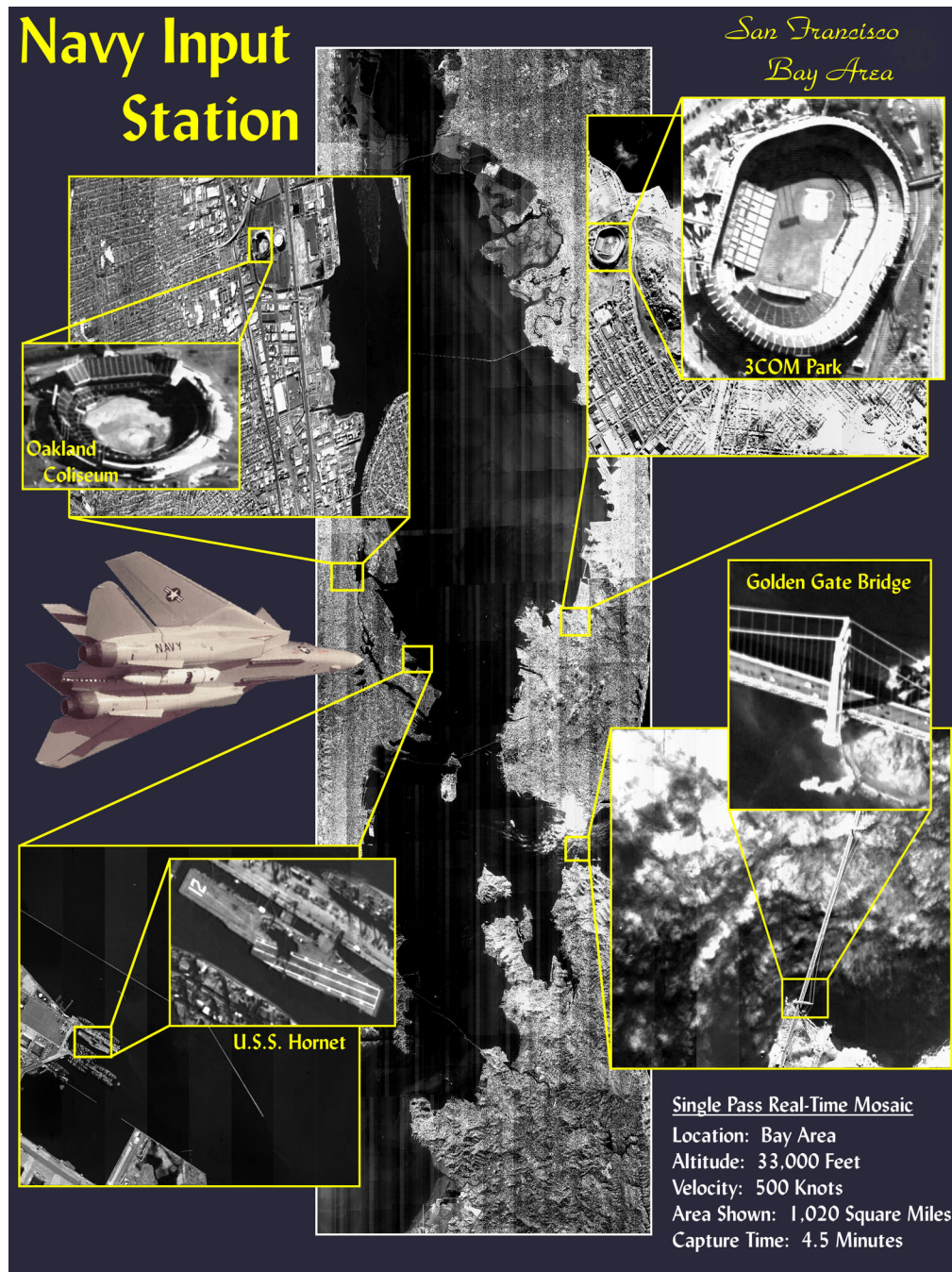
Future Developments

Future generations of the NAVIS system will incorporate advanced, real-time decompression boards developed by SDL/USU under the Advanced Reconnaissance Compression Hardware (ARCH) program. These boards will meet National Imagery Transmission Format Standard (NITFS) certification requirements. This decompression hardware will be compatible with many sensor types (e.g., large format framing and scanning sensors), and will be of modular design to accommodate future higher rate single- and multi-band sensors.

The technology developed for the NAVIS and ARCH systems will be, in turn, used to build the prototype system for the Shared Airborne Reconnaissance Pod (SHARP). The SHARP is planned as the future TAC/RECCE (Tactical/Reconnaissance) system, and its NAVIS ground station will provide the following capabilities:

Simultaneous

- Real-time wideband CDL reception
- Real-time NITFS/ISO image decompression
- Real-time imagery display
- Real-time digital imagery recording.

Oblique coverage (8 frames/swath)

Full resolution (5k x 5k)

Zoomed areas from full res

Navy Input Station

San Francisco Bay Area

3COM Park

Oakland Coliseum

Golden Gate Bridge

NAVY

U.S.S. Hornet

Single Pass Real-Time Mosaic

Location: Bay Area
Altitude: 33,000 Feet
Velocity: 500 Knots
Area Shown: 1,020 Square Miles
Capture Time: 4.5 Minutes

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